NANOPARTICLE CONCENTRATION AND SIZE MEASUREMENTS USING OPTICAL MICROSCOPY AND APPROXIMATE BAYESIAN COMPUTATION

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The widespread use of both artificial and natural functional nanoparticles, e.g. as therapeutic agents, as biomarkers, and for biomedical imaging, motivates the development of accurate and precise characterization methods for submicron size particles in liquid suspension [1]. We have over some years developed a set of methods for size and concentration measurements using particle tracking, optical microscopy, and advanced statistical models based on detection region dimensions, estimated diffusion coefficients, and number concentrations of particles [2]. Notably, these methods work even in undiluted biological fluids like blood. The concept is based on calibrating the size of the detection region in which particles are tracked, using the tracking data itself. Hence, the methods are robust to changes in sample illumination, particle brightness, tracking algorithm, the depth of field of the microscope, and so on. However, one fundamental problem with our early approaches is that approximations in the statistical modelling had to be introduced in order to make parameter estimation tractable. This was later circumvented in [3] by using Approximate Bayesian Computation (ABC), a modern simulation-based statistical inference method generally applicable to modelling and estimating parameters in very complex systems. We will demonstrate the usefulness of this statistical approach combined with advanced microscopy techniques for performing both concentration and size measurements of nanoparticles in liquid suspension.

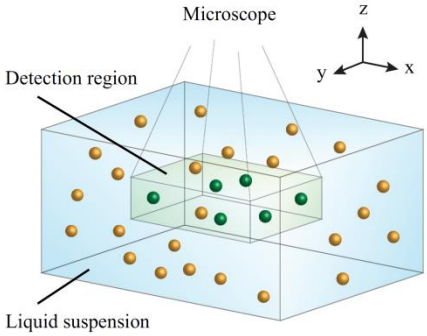

Fig 1: Microscopy setup.

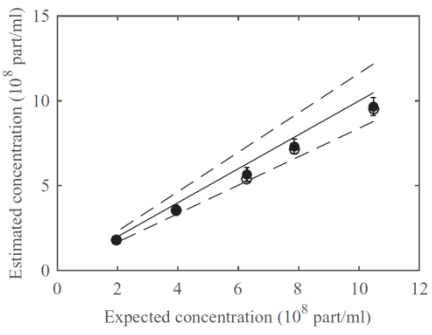

Fig 2: Experimental results.

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